

# Validation of the AUDIT Scale and Factors Associated with Alcohol Use Disorder in Adolescents: Results of a National Lebanese Study

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## Research article

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## Abstract

Background This study objective was to evaluate the prevalence of AUD and related factors (smoking, internet addiction, social anxiety, child abuse, and bullying) among a representative sample of Lebanese adolescents, and to validate and confirm psychometric properties of the AUDIT scale. Methods A cross-sectional study, conducted between January and May 2019, enrolled 1810 adolescents aged between 14 and 17. Alcohol dependence was defined as a high AUDIT score ( $\geq 8$ ; score range 0-40). A principal component analysis technique to confirm the validity of the construct of the AUDIT scale score was done and a confirmatory analysis to assess the structure of the instrument was conducted. Results The mean AUDIT score was  $6.46 \pm 8.44$  and high risk of hazardous alcohol drinking was found in 507 (28.0%) adolescents [95% CI 0.259-0.301]. One factor solution of the AUDIT scale was found after running the factor analysis ( $\alpha$  Cronbach =0.978). Higher cigarette ( $\text{Beta}=0.372$ ;  $p<0.001$ ) and waterpipe ( $\text{Beta}=0.319$ ;  $p<0.001$ ) dependence, higher child sexual ( $\text{Beta}=0.581$ ;  $p<0.001$ ) and neglect ( $\text{Beta}=0.106$ ;  $p<0.001$ ) abuse, higher internet addiction ( $\text{Beta}=0.088$ ;  $p<0.001$ ), separated parents compared to living together ( $\text{Beta}=3.202$ ;  $p<0.001$ ) and higher bullying victimization ( $\text{Beta}=0.143$ ;  $p<0.001$ ) were significantly associated with higher AUDIT scores. Conclusion Alcohol dependence among Lebanese adolescents seems to be influenced by several risk factors, such as cigarette and waterpipe dependence, parents' divorce, higher internet addiction, bullying victimization, and childhood sexual abuse and neglect. Parents and healthcare professionals could use this data for early interventions.

## Background

Adolescence is the transition period from childhood to adulthood. It is characterized by developing knowledge and skills, learning how to manage emotions and relationships, and earning skills to help appreciate and take on adult roles<sup>1</sup>. During this period, adolescents may face, among other issues, problematic alcohol consumption. Despite its known direct impact on overall health outcomes, alcohol use disorder (AUD) is pervasive and endemic among adolescents. It is thought to be a pediatric-onset condition (with one in twenty cases fighting with family or friends and skipping school, disclosing problems related to alcohol drinking) and requires early detection and screening to initiate the appropriate intervention the soonest<sup>2,3</sup>. For example, in 2011, 90% of European teenagers between 15 and 16 had consumed alcohol at least once in their lifetime<sup>4</sup>. In the United States in 2014, 50.9% of surveyed adolescents between 12 and 20 were binge drinkers, and 13.7% were heavy drinkers<sup>4</sup>.

The term AUD is now used in the Diagnostic and Statistical Manual of Mental Disorders 5<sup>th</sup> Edition (DSM-5) to replace alcohol abuse and dependence, previously used in the DSM-4. It is characterized by a dysfunctional alcohol consumption pattern resulting in clinically significant disability or anxiety, as evidenced by various psychosocial, behavioral, or physiological characteristics<sup>5</sup>, and accounts for more than 5% of the global disease burden, as per the World Health Organization (WHO) Global Status Report on Alcohol and Health 2018<sup>6</sup>.

Multiple factors were found to be correlated with AUD among adolescents, such as cigarette smoking; although AUD and smoking usually co-occur, studies showed that smoker adolescents have a higher vulnerability to AUDs<sup>7,8</sup>. Other factors include internet addiction<sup>9,10</sup>, social anxiety<sup>11</sup>, child abuse<sup>12-14</sup>, and bullying victimization<sup>15,16</sup>.

Social anxiety, defined as an extreme fear of being assessed negatively by others, has been reported as a potentially significant factor affecting the use of alcohol and cigarettes in adolescents<sup>17</sup>, but the association between anxiety disorders and teenage alcohol consumption is still not distinct<sup>18,19</sup>.

Another factor related to AUD is child maltreatment. It includes several subtypes: sexual, physical, and emotional abuse, and neglect. Studies revealed that unfavorable childhood was associated with two significant public health risks, AUD and substance use disorder. Indeed, psychological, physical, and sexual abuse were found to be associated with increased alcohol use among adolescents and an increase in the likelihood that a substance use disorder will occur later in life<sup>12,13</sup>. It was further suggested that among the four forms of childhood maltreatment, emotional abuse could be the main driver of pathological drinking among victims of child abuse<sup>14</sup>.

Bullying victimization, whether physical, verbal, relational, or cyberbullying, was also linked to higher AUD. At some point in their life, about 15-30% of youth report being intimidated<sup>15,16</sup>. According to the type of aggression<sup>20</sup>, victims may experience variable issues of mental wellbeing<sup>21</sup>, including alcohol use, suicidal ideation, and illegitimate drug use<sup>22</sup>.

Alcohol consumption is closely linked to religious beliefs in Eastern Mediterranean countries, where Islam is the predominant religion<sup>23</sup>. Therefore, it is believed that, because it is prohibited by Islam, alcohol consumption is underestimated in these conservative societies, where talking about alcohol is still a taboo<sup>23</sup>. A systematic review noted that in Lebanon, epidemiological work on alcohol consumption and its effects could be carried out because of theological diversity and a more liberal society<sup>24</sup>. Moreover, the Lebanese context largely affects alcohol use among young people. Indeed, alcohol policies are poorly implemented despite laws and regulations, dating back to the 1940s and 1960s, prohibiting the sale of alcohol to minors<sup>25</sup>. As per these regulations, penalties and fines are as low as \$ 4 for individuals promoting alcoholic beverages to minors under the age of eighteen, and \$ 13 for owners and staff of bars, pubs, or other public places selling alcohol to minors, or making them drunk<sup>25</sup>. Also, alcoholic beverages in Lebanon are easily accessible and inexpensive<sup>25</sup>.

In Lebanon, the majority of studies have evaluated the prevalence of alcohol consumption and its consequences among adults but not in young people<sup>26,27</sup>. Nonetheless, few alcohol-related research among Arab and Lebanese adolescents could be gathered<sup>2</sup>. The results of the Global School-based Student Health Survey (GSHS)<sup>28</sup> in schoolchildren aged 13-17 years from 73 countries, including 16 in the Eastern Mediterranean region, showed that among those who drank alcohol, the majority had their

first drink before the age of 14, and a substantial percentage got intoxicated at least once in their lifetime 2,28.

To assess alcohol consumption, drinking habits, and other alcohol-related issues, the WHO developed a 10-item tool, the Alcohol Use Disorder Identification Test (AUDIT)<sup>29</sup>. This validated questionnaire is widely used across countries to evaluate hazardous drinking and alcohol consumption patterns that increase the risk of physical, mental and social harm in adults and adolescents<sup>30 31-33</sup>. This tool has been validated among prisoners in the United Arab Emirates<sup>34</sup> and Lebanese university students<sup>35</sup>, but there is no information about its validation among adolescents in Lebanon. Moreover, no study had evaluated yet the prevalence and the variables related to AUD among adolescents in Lebanon, taking into account the extent of alcohol-related public health burden and the associated morbidity and mortality.

Therefore, our study aims to evaluate the prevalence of AUD and related factors (smoking, internet addiction, social anxiety, child abuse, and bullying victimization) among a representative sample of Lebanese adolescents, and to validate and confirm psychometric properties of the AUDIT scale.

## Methods

### Participants

#### Minimal sample size

In the absence of similar studies in the country, it was hypothesized that waterpipe smoking would have a medium effect ( $r=0.3$ ) on increasing AUD. The G-power software calculated a minimal sample of 134 participants, considering a power of 95%. Out of 2000 questionnaires distributed, 1810 (90.5%) were completed and collected back.

#### Questionnaire

The self-administered questionnaire used was in Arabic, the native language of Lebanon, and required approximately 60 minutes to complete. Students were asked to fill it out in the classroom to avoid their parents' influence when answering the questions. A member of the research team was available in the classroom to clarify questions that were not understood by the students. At the end of the process, the completed questionnaires were collected back in closed boxes and sent for data entry. The anonymity of the participants was guaranteed during the data collection process.

The first part evaluated the participants' sociodemographic information (i.e., age, gender, smoking status, parents' status). The Body Mass Index (BMI) ( $\text{kg}/\text{m}^2$ ) was calculated based on self-reported heights and weights of participants. The household crowding index was calculated by dividing the number of persons living in the house by the number of rooms, excluding the bathroom and the kitchen<sup>59</sup>.

The second part of the questionnaire was composed of the different scales used:

### The Alcohol Use Disorders Identification Test (AUDIT)

This self-reported tool assesses alcohol use, drinking patterns, and alcohol-related issues<sup>60</sup>. Hazard alcohol disorder (HAD) is considered when participants score 8 or more ( $\alpha_{\text{Cronbach}}=0.978$ ).

### Liebowitz Social Anxiety Scale (LSAS)

This self-reported scale features 24 items graded on a Likert scale from 0 to 3, divided into two subcategories (13 questions about performance anxiety, and 11 about social situations)<sup>61,62</sup> ( $\alpha_{\text{Cronbach}}$  total score=0.969,  $\alpha_{\text{Cronbach}}$  fear subscale=0.952,  $\alpha_{\text{Cronbach}}$  avoidance subscale=0.951).

### Internet Addiction Test (IAT)

The Arabic version<sup>63</sup> validated among Lebanese adolescents<sup>64</sup> was used. It consisted of 20 items scored on a Likert scale from 0= does not apply/never to 5=always applies. Higher scores defining higher internet addiction ( $\alpha_{\text{Cronbach}}=0.925$ ).

### Lebanon Waterpipe Dependence Scale-11 (LWDS-11)

The LWDS-11 test was used to assess waterpipe dependence<sup>65</sup>. It consists of 11 items measured on a four-point Likert scale from 0 to 3, with higher scores reflecting higher waterpipe dependence ( $\alpha_{\text{Cronbach}}=0.888$ ).

### Fagerström test for nicotine dependence (FTND)

This scale consists of 6 items; yes/no items are scored from 0 to 1 and multiple-choice items are scored from 0 to 3. The higher the total Fagerström score, the more intense the patient's physical dependence on nicotine<sup>66</sup> ( $\alpha_{\text{Cronbach}}=0.825$ ).

### Child abuse self-report scale (CASRS)

This 38-item scale is divided into 4 subscales of child abuse: psychological abuse (14 items), neglect (11 items), physical abuse (8 items), and sexual abuse (5 items). It is scored on a 4-point Likert scale (0= Never, 1=Sometimes, 2= Most often, 3= Always)<sup>67</sup>, with higher scores indicating more childhood abuse<sup>68</sup>. The Cronbach's alpha values for each subscale were as follows:  $\alpha_{\text{Cronbach}}$  psychological abuse=0.973,  $\alpha_{\text{Cronbach}}$  neglect=0.971,  $\alpha_{\text{Cronbach}}$  physical abuse=0.966, and  $\alpha_{\text{Cronbach}}$  sexual abuse =0.954.

### The Illinois Bully scale (IBS)

The IBS is a research-validated tool used to measure bullying and victimization by directly surveying students<sup>69</sup>, with higher scores reflecting higher bullying victimization ( $\alpha_{\text{Cronbach}}=0.975$ ).

### **Translation procedure of the questionnaire**

A forward and backward translation was conducted for all the scales. One translator was in charge of translating the scales from English to Arabic, and another one was involved in the translation from Arabic back to English. Discrepancies between the original and translated English versions were resolved by consensus.

## Statistical analysis

Data analysis was performed on SPSS software version 25. Pearson correlation was used for linear correlation between continuous variables and the chi-square and Fisher exact tests for categorical variables. The Student t-test was used to compare the means of 2 groups, while the ANOVA test was used to compare three groups or more. Pearson's correlation was used to check for an association between two continuous variables. To adjust for multiple testing, the p value was set using the Bonferroni correction:  $p = \alpha/m$ , where  $\alpha$  is the desired overall alpha level ( $\alpha=0.05$ ) and  $m$  is the number of hypotheses/tests conducted ( $m=23$ )<sup>70</sup>; thus, the calculated p value was  $0.05/23=0.002$ . A stepwise linear regression was conducted, taking the AUDIT total score as the dependent variable. To minimize confounding, independent variables entered in the final model were those that showed a  $p<0.1$  in the bivariate analysis<sup>71</sup>. A  $p<0.05$  was considered significant.

A principal component analysis was performed to confirm the validity of the construct of the AUDIT scale score in the Lebanese population. The exploratory analysis for the validation of the AUDIT scale was conducted on half of the sample (subsample 1:  $n = 905$ ), and the confirmatory analysis on the other half (subsample 2:  $n = 905$ ). The total sample ( $n=1810$ ) was used for the bivariate and multivariable analysis. The Kaiser-Meyer-Olkin measurement of sampling adequacy and Bartlett's sphericity test were appropriate. The factors retained corresponded to Eigenvalues greater than one.

Second, a confirmatory factor analysis was carried out in subsample 2 using the maximum likelihood method for discrepancy function to assess the structure of the instrument. Several goodness of fit indicators were reported: the Relative Chi-square ( $\chi^2/\text{df}$ ) that serves as goodness of fit index (cut-off values:<2.5), the Root Mean Square Error of Approximation (RMSEA) that tests the fit of the model to the covariance matrix (close and acceptable fit are considered for values <0.05 and <0.11, respectively), the Goodness of Fit Index (GFI), and the Adjusted Goodness of Fit Index (AGFI) (acceptable values are  $\geq 0.90$ )<sup>72</sup>. Cronbach's alpha was also recorded to assess the reliability analysis of the total score and subscale factors.

## Results

The sociodemographic characteristics of the participants are summarized in Table 1. The mean age was  $15.42 \pm 1.14$  years, with 53.3% females, 25.9% smokers, and 11.9% with separated/divorced parents. The mean AUDIT score in our sample was  $6.46 \pm 8.44$  (median=2); also, 507 (28.0%) had high risk of hazardous alcohol drinking (HAD) (AUDIT scores  $\geq 8$ ) [95% CI 0.259-0.301].

### Validation of the AUDIT scale

## ***Subsample 1***

### ***Factor analysis***

None of the items from the AUDIT scale has been removed. The factor analysis of the AUDIT was run on the full sample (Total n=905). Items converged on a one-factor solution with Eigenvalues greater than 1, accounting for a total of 85.88% of the variance. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.832, with a significant Bartlett's sphericity test ( $p<0.001$ ). Moreover, a high Cronbach's alpha was found for the full scale (0.978) (Table 2).

## ***Subsample 2***

### ***Confirmatory factor analysis***

A confirmatory factor analysis was run on subsample 2 (n=905), using the one-factor structure obtained in Sample 1. The results were as follows: the Maximum Likelihood Chi-Square=257 and Degrees of Freedom=104, which gave a  $\chi^2/df=2.4$ . For non-centrality fit indices, the Steiger-Lind RMSEA was 0.10 [0.084-0.155]. Moreover, the Joreskog GFI equaled 0.91 and AGFI equaled 0.92.

### ***Bivariate analysis***

The results of the bivariate analysis showed that a higher AUDIT score was significantly found in adolescents whose parents are separated compared to those whose parents live together (12.96 vs. 5.56), and in cigarette (16.69 vs. 3.62) or waterpipe (15.35 vs. 3.53) smokers compared to non-smokers. A higher mean AUDIT score was found in Beirut (8.42) and Mount Lebanon (8.06) compared to North (5.83), South (5.29), and Bekaa (5.61) ( $p<0.001$  for the whole trend). The post hoc analysis showed that the comparison of the mean AUDIT scores was significantly different between Beirut vs. North ( $p=0.002$ ), Beirut vs. South ( $p<0.001$ ), Beirut vs. Bekaa ( $p<0.001$ ), Mount Lebanon vs. South ( $p<0.001$ ), and Mount Lebanon vs. Bekaa ( $p<0.001$ ). However, no significant difference was found between males and females (6.04 vs. 6.82;  $p=0.056$ ), and age was not correlated with AUD ( $r=0.009$ ;  $p=0.719$ ). Furthermore, higher fear ( $r=0.276$ ) and avoidance ( $r=0.171$ ), bullying victimization ( $r=0.383$ ), cigarette ( $r=0.576$ ) and waterpipe ( $r=0.523$ ) dependence, internet addiction ( $r=0.325$ ), and childhood physical ( $r=0.438$ ) and sexual ( $r=0.468$ ) abuse were significantly associated with higher AUDIT scores (Table 3).

### ***Multivariable analysis***

The results of a stepwise linear regression, taking the AUDIT score as the dependent variable, showed that higher AUDIT scores were significantly associated with higher cigarette ( $Beta=0.372$ ;  $p<0.001$ ) and waterpipe ( $Beta=0.319$ ;  $p<0.001$ ) dependence, higher childhood sexual abuse ( $Beta=0.581$ ;  $p<0.001$ ) and neglect ( $Beta=0.106$ ;  $p<0.001$ ), higher internet addiction ( $Beta=0.088$ ;  $p<0.001$ ), higher bullying victimization ( $Beta=0.143$ ;  $p<0.001$ ), and having separated parents compared to living together ( $Beta=3.202$ ;  $p<0.001$ ) (Table 4).

## Discussion

To our knowledge, this is the first national study to determine factors related to alcohol use disorder among adolescents. Our research revealed that higher AUD in Lebanese adolescents was associated with cigarette and waterpipe smoking, internet addiction, child abuse and neglect, bullying, and in adolescents with divorced parents.

Concerning psychometric properties in our study, we found that the AUDIT score had an outstanding Cronbach's alpha of 0.978, in agreement with other studies<sup>31,33,73</sup>. Moreover, the one-factor model of the Arabic version was better than that of the Portuguese model<sup>74</sup> in terms of internal consistency and number of factors, making this tool useful in identifying risk-taking, signs of addiction, and unhealthy alcohol use among adolescents in Lebanon. Accordingly, using the AUDIT scale to assess AUD among Lebanese adolescents is recommended. However, additional studies are needed to further examine validity features of the AUDIT scale (face validity and criterion validity).

Our results showed that the prevalence of AUD risk among Lebanese adolescents was 28.0%, in line with other studies<sup>25,75,76</sup>. Besides the correlations with the psychological factors identified in this research, this proportion may also be related to the normalization of alcohol use, its broad availability, particularly in Beirut and Mount Lebanon, the inaction of the government, in addition to existing indefinite policies regarding the illegal sale of alcohol to minors, low excise taxes on alcohol, poor regulatory framework for alcohol advertising and promotion, lack of effectively reported adverse effects of alcohol consumption, and the impact of friends and cousins on the young population<sup>23</sup>.

A notably higher mean AUDIT score was found in Beirut and Mount Lebanon compared to the other districts. This might be related to the religious distribution in those two districts, while North, South, and Bekaa have most of the Lebanese Muslim rural populations<sup>23,26</sup>. This distribution further corroborates the validity of the AUDIT scale. Indeed, in Islam, alcohol drinking is forbidden by the Qur'an and is considered to be a satanic act<sup>77</sup>. Moreover, devout Muslims adhere harshly to the expressions of the Prophet<sup>78</sup>. Abstaining from alcohol consumption is primarily linked to its illegality but also to the feeling of guilt that followers of Islam may have if they drink<sup>78</sup>. Accordingly, adolescents raised in families where the Islamic faith is practiced have little or no alcohol drinking problems or misuse.

### ***Cigarette and waterpipe dependence and AUD***

In the present study, a higher dependence on cigarette smoking was remarkably associated with higher AUDIT scores, in agreement with other studies<sup>8,79</sup>. Also, waterpipe smoking was related to higher AUDIT scores, with a few previous studies showing this association<sup>79,80</sup>. In fact, waterpipe smoking is addictive and associated with nicotine dependence among adolescents<sup>81</sup>. It is generally assumed that young smokers are at higher vulnerability to AUD than non-smokers at equal rates of alcohol consumption<sup>8</sup>, consistent with the results reported by Kandel and Chen<sup>82</sup>. To clarify the association between smoking and AUD, Grucza et al., 2006 suggested that a pharmacological influence may result from smoking by

expanding the vulnerability of smokers to develop AUD<sup>8</sup>. A genetic predisposition or other obscure factors may also be involved in the initiation of youth smoking, which may play a role in developing AUD<sup>8</sup>. Exposure of adolescents to nicotine may alter gene expression and brain development, thereby modifying future social reactions to other drugs, increasing susceptibility to alcohol and other substance use disorders, and enhancing the impacts of many drugs of abuse. This has also been demonstrated in animal studies exploring the effects of nicotine on the central nervous system of adolescent rats<sup>83-87</sup>.

### ***Internet addiction and AUD***

Our findings revealed that a higher internet addiction was associated with a higher AUDIT score, in line with previous results<sup>88</sup>. Internet addiction is a potentially dangerous condition with many negative consequences<sup>89,90</sup>, such as depression, anxiety isolation, loneliness<sup>91</sup>, loss of self-esteem, in addition to personal, social, and academic problems, and an increased hazardous alcohol use among adolescents<sup>88-90</sup>. Indeed, adolescents can resort to alcohol misuse to cope with the repercussions following problematic internet use and escape from their reality<sup>88</sup>. Moreover, problematic internet use and hazardous alcohol consumption may share similar vulnerabilities, such as positive attitudes toward alcohol, family history of alcoholism, and the presence of deviant peers<sup>10</sup>, thereby raising the probability of presenting together among young people, with a slight advance for problematic Internet use<sup>88</sup>. Like in other behavioral addictions, adolescents may abuse the internet to produce a satisfactory outcome<sup>92,93</sup>. Also, having a behavioral problem such as Internet addiction will decrease the threshold of other addictions, thereby increasing the vulnerability to AUD<sup>94</sup>.

### ***Childhood sexual abuse, neglect, and AUD***

Our results highlighted that an increase in childhood sexual abuse was correlated with higher AUD, consistent with those of other studies documenting this association in adolescents<sup>13,95</sup>. Several explanatory models are suggested to clarify this association. First, the relationship is likely based on psychiatric issues, as childhood sexual victimization frequently leads to depression and anxiety<sup>96</sup>. Young people who do not have the appropriate system to deal with bad experiences can drink alcohol to cope with their traumatic childhood or try to escape it, and increase their alcohol consumption, thinking they are solving their problems and falling into alcohol misuse at some point<sup>95,97</sup>. Moreover, several studies found that antisocial behaviors can also be a consequence of childhood victimization<sup>98,99</sup>; thus, youth involved in deviant peer groups will experience more AUD<sup>97</sup>.

Furthermore, higher neglect was found to be associated with a significantly higher AUDIT scores, in line with previous research<sup>100</sup>. Unfavorable life experiences during childhood may lead to the development of post-traumatic stress disorder, which might lead to an inescapable effect on biological stress response mechanisms and mental health, driving victims to respond to their previous traumatic experiences by drinking alcohol<sup>101</sup>. Also, ignored children cannot develop a valuable relationship with their inert primary

caregiver and are more prone to build up a sense of vulnerability, poor social and companionship skills<sup>102,103</sup>, degradation of self-confidence and self-control<sup>100</sup>, thereby leading to increased alcohol use.

### ***Bullying victimization and AUD***

Our findings showed that higher bullying victimization was significantly associated with more AUD, concurring with those of previous research<sup>22,104</sup>. Bullying itself is a major global health problem with serious consequences<sup>105,106</sup>, long linked to issues of self-worth<sup>107,108</sup>, loneliness, depression, anxiety, and physical symptoms<sup>109</sup>. It is suggested that AUD is a means to cope with symptoms of mood disorders developed after being bullied<sup>109</sup>, to ease the anxiety and escape reality. Some may use alcohol as a way to emphasize their social image and improve their previously diminished self-worth<sup>109</sup>. Additionally, youth tend to seek a peer-to-peer environment because they cannot solve bullying problems on their own, which seems to increase the susceptibility to engage in AUD<sup>104</sup>.

### ***Separated Parents and AUD***

In this context, more AUD was also found in adolescents whose parents are separated compared to those whose parents live together, consolidating previous findings<sup>110,111</sup>. Deviant conduct is probably produced by low levels of attachment and loyalty to the family, resulting in decreased infant monitoring and parental involvement following parents' separation<sup>111</sup>. Moreover, these findings highlight the crucial role parents play in influencing their children's behavior towards alcohol and actual alcohol consumption<sup>23,111</sup>. Parental absence may result in a reduced fruitfulness/efficacy of parenting<sup>112</sup> and increased access to alcohol, thereby increasing the likelihood of AUD in adolescents<sup>113</sup>. Also, since youth must meet emotional demands during their parents' divorce, prominent links with substance-using peers will be developed<sup>114,115</sup>. Therefore, peers are thought to be potentially important in determining drinking habits<sup>23</sup>.

### **Clinical Implications**

The findings of this study carry significant implications for interventions. Due to the immense gaps in the laws and their implementation in Lebanon, there is an urgent need to define new and updated approaches to protect the youth, by raising awareness, setting a legal minimum drinking age<sup>116</sup>, and enforcing the laws<sup>24</sup>. Thus, an evidence-based national alcohol harm reduction plan is warranted<sup>25</sup>. Also, families, schools, public health authorities, and communities have to inform youth about alcohol consumption and focus on its negative aspects<sup>117</sup>. In this context, families are one of the main sources that drive adolescents into alcohol consumption by making it accessible<sup>25,118-120</sup>. Parent-child communication about the use of alcohol and its associated harms is also essential in preventing AUD<sup>25</sup>. Reinforcing school-based alcohol awareness and including a confidential academic-based counseling is also paramount in preventing AUD<sup>25</sup>.

At the level of community, awareness messages are required to highlight the risks of alcohol consumption, taking the problem into public conversation and helping to promote effective policy implementation<sup>23,121</sup>. Finally, establishing medical and rehabilitation services and conducting further research in this field are also needed<sup>23</sup>.

## **Limitations**

This research has some limitations, and few potential weaknesses are worth to mention. First, the current study is limited by its cross-sectional design and thus, showed risk factors associated with Alcohol Use Disorder but could not establish causality. In addition, although 18 religious communities share their convictions freely in Lebanon, some still perceive alcohol as a taboo, and as a consequence, some schools refused to participate in our investigation. Participants were analyzed using a scoring tool and not through a clinical assessment test; therefore, we couldn't affirm the precision of responses. All the scales used, except the IAT, have not been validated among Lebanese adolescents, which might have led to a non-differential information bias. Finally, a selection bias might be present because of the selection process of schools since public schools were not included. However, the relatively large sample size allows a close approximation of the findings to the general adolescent population, especially since no such studies, taking into consideration a representative sample from all regions, were previously conducted in Lebanon.

## **Conclusion**

Our findings revealed that cigarette and waterpipe dependence, higher internet addiction, bullying victimization, childhood sexual abuse and neglect, and parental divorce were associated with higher AUDIT scores. Recognizing these factors is important for parents and healthcare professionals who can use this data for early intervention. The prevalence of alcohol use disorder found in our study should exhort the government to include a minimum legal age to drink, regulate advertising of alcohol, set fines for those who sell alcohol and promote it in minors, particularly those targeting adolescents. Increased efforts are needed to collect data and determine the extent of alcohol consumption and translate it into evidence-based guidelines that may be used to direct policy and practice.

## **Abbreviations**

GSHS=Global School-based Student Health Survey

BMI=Body Mass Index

AUDIT=Alcohol Use Disorders Identification Test

LSAS=Liebowitz Social Anxiety Scale

IAT=Internet Addiction Test

MDI-C=Multiscore Depression Inventory for Children

LWDS-11=Lebanon Waterpipe Dependence Scale-11

FTND=Fagerstrom test for nicotine dependence

CASRS=Child abuse self-report scale

RMSEA=Root Mean Square Error of Approximation

GFI=Goodness of Fit Index

AGFI=Adjusted Goodness of Fit Index

HAD=hazardous alcohol drinking

## Declarations

### **Ethics Approval and Consent to Participate**

The Psychiatric Hospital of the Cross Ethics and Research Committee approved this study protocol (HPC-012-2019). The students' parents gave their written informed consent before starting the data collection.

**Consent for publication:** not applicable.

**Availability of data and materials:** The authors do not have the right to share any data information as per their institutions policies.

**Competing interests:** The authors have no conflicts of interest to report.

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**Authors' contributions:** MS, SO and SH conceived and designed the survey. CH, PS and SH were involved in the statistical analysis and data interpretation. JH wrote the manuscript. RH, PS and HS reviewed the manuscript. MA and JH involved in the data collection and data entry. HS edited the paper for English language. All authors read the manuscript, critically revised it for intellectual content, and approved the final version.

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## Tables

**Table 1: Sociodemographic characteristics of the sample population (N=1810)**

	<b>Frequency (%)</b>
<b>Gender</b>	
Male	844 (46.7%)
Female	963 (53.3%)
<b>Parents status</b>	
Living together	1581 (88.1%)
Separate	213 (11.9%)
<b>Smoking status</b>	
Yes	468 (25.9%)
No	1342 (74.1%)
	<b>Mean ± SD</b>
<b>Age (years)</b>	15.42 ± 1.14
<b>BMI (kg/m<sup>2</sup>)</b>	21.95 ± 4.21
<b>Household crowding index</b>	1.01 ± 0.64

**Table 2. Principal component analysis results of the promax rotation of the AUDIT scale.**

<b>Question</b>	<b>Item</b>	<b>Loading factor</b>
Has a relative or friend or a doctor or another health worker been concerned about your drinking or suggested you cut down?	10	0.965
Have you or someone else been injured as a result of your drinking?	9	0.964
How often during the last year have you had a feeling of guilt or remorse after drinking?	7	0.963
How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	6	0.956
How often during the last year have you been unable to remember what happened the night before because you had been drinking?	8	0.951
How often during the last year have you found that you were not able to stop drinking once you had started?	4	0.943
How often do you have six or more drinks on one occasion?	3	0.938
How often during the last year have you failed to do what was normally expected from you because of drinking?	5	0.929
How many drinks containing alcohol do you have on a typical day when you are drinking?	2	0.920
How often do you have a drink containing alcohol?	1	0.711

**Table 3: Bivariate analysis taking the AUDIT total score as the dependent variable**

	AUDIT total score	P -value
	Mean ± SD	
<b>Gender</b>		
Male	6.04 ± 8.43	0.056
Female	6.82 ± 8.43	
<b>Parents status</b>		
Living together	5.56 ± 8.01	<0.001
Separate	12.96 ± 8.67	
<b>Cigarette smoking status</b>		
Yes	16.69 ± 7.84	<0.001
No	3.62 ± 6.07	
<b>Waterpipe smoking status</b>		
Yes	15.35 ± 8.62	<0.001
No	3.53 ± 5.97	
	Correlation coefficient	P -value
Liebowitz- fear score	0.276	<0.001
Liebowitz- avoidance score	0.171	<0.001
Bullying/victimization score	0.383	<0.001
LWDS total score	0.523	<0.001
FTND total score	0.576	<0.001
IAT score	0.325	<0.001
House crowding index	0.030	0.214
Physical activity score	0.011	0.657
Psychological abuse scale	0.435	<0.001
Child abuse neglect scale	0.069	0.006
Child abuse physical scale	0.438	<0.001
Child abuse sexual scale	0.468	<0.001

Numbers in bold indicate significant p-values.

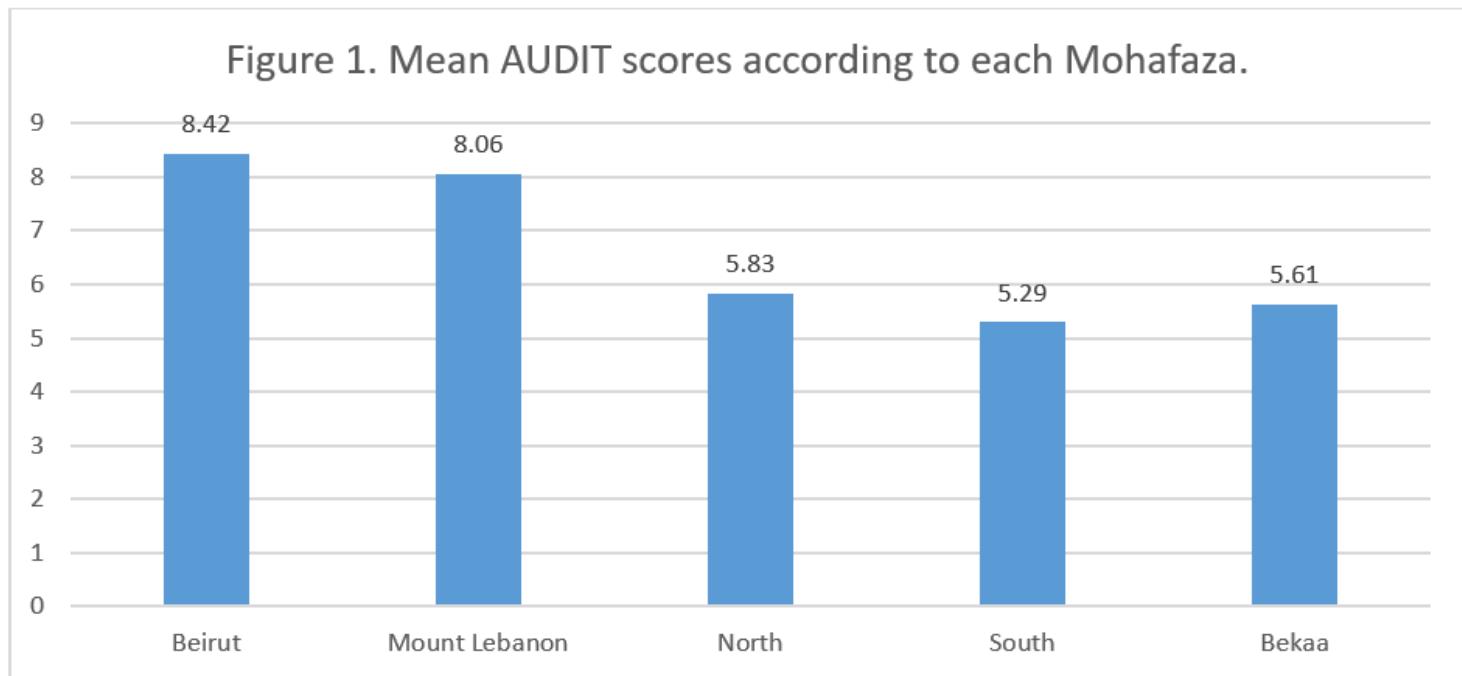
**Table 4: Multivariable analysis: Linear regression taking the AUDIT score as the dependent variable.**

Variable	Unstandardized Beta	Standardized Beta	p-value	Confidence Interval	
				Lower	Upper
FTND - score	0.372	0.135	<0.001	0.210	0.534
LWDS-11 - score	0.319	0.353	<0.001	0.268	0.370
Child abuse sexual scale	0.581	0.266	<0.001	0.497	0.665
Child abuse neglect scale	0.106	0.129	<0.001	0.077	0.135
IAT - score	0.088	0.195	<0.001	0.071	0.104
Parents status (separate vs. living together*)	3.202	0.133	<0.001	2.343	4.060
Bullying/victimization score	0.143	0.124	<0.001	0.098	0.189

\*Reference group

Variables entered in the model: gender, parents' status, IAT score, LWDS-11 score, FTND, Liebowitz fear score, Liebowitz avoidance score, Psychological abuse scale, Child abuse neglect scale, Child abuse physical scale, Child abuse sexual scale and Bullying/victimization score.

## Figures



**Figure 1**

Mean AUDIT scores according to each Mohafaza.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [STROBEchecklist.pdf](#)